

SCREENING FOR BLAST AND BROWN SPOT DISEASES OF PADDY IN HILLY ZONE OF KARNATAKA

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Abstract: Rice (*Oryza sativa* L.) is the principal staple food for more than two billion people; most of them live in rural and urban areas of tropical and subtropical Asia and has two cultivated and 22 wild species. The cultivated species are *Oryza sativa* and *Oryza glaberrima*. *Oryza sativa* is grown all over the world. Rice is known to suffer from number of diseases caused by fungal, bacterial and viral origins. Identification of resistant genotypes is again an essential continuous process either to recommend for cultivation in endemic area or to use as donors of the resistant genes. In view of these, the present investigation of evaluation of 354 rice varieties/genotypes against leaf and neck blast and brown spot diseases were carried out during *Kharif* 2015 at AHRS, Ponnampet to identify the sources of resistance under field conditions. 354 entries were tested in Uniform blast screening nursery for leaf blast and transplanted field of screening for neck blast and brown spot diseases resistance of paddy, out of which none of the entries showed entries were found highly resistant, Resistant and moderately resistant reaction to leaf blast. Dhanrasi (NC), 24545, CSR 36 (Alkaline), 24538, CSR 23 (Inland saline), 24541, 3209, Tetep (DP), 24443, 23565, 24537, 23782, Jaya (Yield check), 24536, Shobini (NC), US 321 (HS), 23680, 24599, 3211, 23339, entries were found moderately susceptible reaction to leaf blast. The same entries were also screened for Neck blast disease out of which 37 entries i.e., 23561, 24537, 24545, CSR 36(Alkaline), CSR 23 (Inland saline), 24606, 23680, 2414, NDR359 (NC), Saita (NC), 23933, 23066, 23052, 23895, 24035, 24008, Jaya (Yield check), 24336, 24630, 24658, 24385, 24365, 24260, 24268, 24816, 24309, 24823, 24825, 24815, 24351, 23656, US 312 (HC), 24796, Tetep, 25663, 25678, Tetep (DP), were found highly resistant, remaining entries were found resistant to highly susceptible reaction to Neck blast. Similarly, the same entries were also screened for brown spot disease out of which none of the entries found highly resistance to resistance and 32 entries i.e., IET- 23565, 24367, 24545, CSR 36 (Alkaline), Jaya (Yield Check), 24536, BPT 5204 (SC), 23735, 23933, 23066, CST 7-1 (CS), 24424, FL 478 Check with Saltol 1, 24777, 24319, DRRH 3 (HC), 24385, 24395, 24412, 23725, Swarna (NC), 24246, 22919, 24309, 24844, 24823, 24340, 24815, 26356, 25676, 25677, Swarna (RP), were found moderately resistant reaction to brown spot disease. The remaining entries were found moderately susceptible to highly susceptible reaction to brown spot disease.

Key words: Rice, Screening, Blast, Brown spot and Diseases

INTRODUCTION

Rice (*Oryza sativa* L.) is an important cereal crop belonging to the family Poaceae. Rice is the most important staple food crop and grown in India providing of 43 per cent of calorie requirement for 70 per cent of the Indian population. India

is the largest rice growing country accounting for about one third of the world acreage under the crop. Total estimated area under rice in India is 43.97 m ha with a production of 116.42 million tons (Anon., 2019). West Bengal has the highest rice production, while Punjab has the

highest productivity of rice among the different rice growing states of India. India contributes 21.5 per cent of global rice production. Within the country, rice occupies one-quarter of total cropped area, contributes about 40 to 43 per cent of total food grain production and continues to play a vital role in the national food and livelihood security system. Total area under rice in Karnataka is 1.42 million ha with a production of 3.6 million tones accounting for a productivity of 2.62 t/ha (Anon., 2019). India is one of the leading exporters of rice, particularly basmati rice.

Rice suffers from many biotic and abiotic factors which result in the lower productivity. Among the biotic factor it suffer from fungal diseases viz., blast (*Pyricularia oryzae*), brown leaf spot (*Bipolaris oryzae* / *Helminthosporium oryzae*), stem rot (*Sclerotium oryzae*), sheath blight (*Rhizoctonia solani*), sheath rot (*Sarocladium oryzae*), bacterial disease such as bacterial blight (*Xanthomonas oryzae* pv. *oryzae*) and viral disease such as (rice tungro virus) nematode disease such as rice root knot (*Meloidogyne graminicola*) are important. Among fungal diseases blast and brown spot disease is of economic importance.

In India, the disease was first recorded in Thanjavore delta of south India in 1918 by Mc Rae (1922). However, it attracted the attention only when a devastating epidemic occurred in 1919 (Padmanabhan, 1965).

Among the fungal disease, brown leaf spot of rice incited by *Helminthosporium oryzae* is a major disease occurring in almost all the rice growing areas of the world causing 5 per cent yield loss across all lowland rice production situations in south and Southeast Asia (Savary , 2000).

The pathogen attacks all the aerial parts of plants at any stage of crop growth right from germination to harvest. The disease occurs as seedling blight, leaf blast, node blast, neck or panicle blast and grain spot. Seed and soil borne infection during germination and thereafter on tender seedling cause, seedling blight leading to death of seedling. Leaf blast is characterized by production of large spindle shaped lesions with ashy grey centres with brown margins drastically reduce crop growth and tillering. The infected node or neck tissues became soft and rotted.

The node or neck blast is considered as the most destructive phase of the disease attacking prior or after flowering and grain formation, causing drastic reduction in grain quality and quantity of produce. The infection on grain produced dark brownish black spot.

Blast disease commonly occurs in few paddy growing areas like Mandya, Kodagu, Shivamogga, Uttara Kannada, Dakshina Kannada, Mysore and Chickmagalur districts (Anon., 1981). The occurrence of disease in moderate to severe form in hilly areas of Karnataka is mainly due to indiscriminate use of nitrogenous fertilizers, heavy rainfall, monocropping and repeated cultivation of the crop. This leads to severe losses in grain yield of the crop. Moreover, repeated cultivation of paddy would not only make the higher inoculum build up but also aggravate the disease problem.

Cultivation of resistant genotypes is the effective and cheaper method to combat the disease as compared to the chemical control. Hence, several genotypes should be screened to identify the resistant genotypes. In view of these, the present investigation of evaluation of 354 rice varieties/genotypes against blast and brown spot diseases were carried out during *Kharif* 2015 at AHRS, Ponnampet to identify the sources of resistance under field conditions.

MATERIAL METHODS

Screening of rice genotypes against leaf blast disease in Uniform Blast Nursery (UBN) pattern:

The experiment was conducted during *Kharif* 2015 at AHRS, Ponnampet. Screening of rice against *P. Oryzae* was carried out to know the source of resistance against leaf blast disease under natural epiphytotic condition. 354 paddy germplasm lines were evaluated against leaf blast disease. These germplasm lines were sown on 29/07/2015 in UBN (Uniform Blast Nursery) pattern. It is an identification of naturally existing blast strains in the hotspot locality. In this technique, nursery beds of 0.5 m width and length of 50 m were raised using spade, all around the bed the most susceptible checks were sown to serve as a source of inoculums for spreading the disease. The susceptible and resistant checks were sown initially and each test

entry were sown at 10 cm apart in one line and after every 20 test entries again susceptible and resistant checks were sown. Disease reactions were recorded by using 0-9 scale given below.

Scoring for leaf blast was done at nursery stage by using following scale given by IRRI (1996)

Rating scale	Disease severity	Host response
0	No lesion observed	Highly Resistant
1	Small brown specks of pin point size	Resistant
2	Small roundish to slightly elongated, necrotic grey spots, about 1-2 mm in diameter, with a distinct brown margin. Lesions are mostly found on the lower leaves	Moderately Resistant
3	Lesion type same as in 2, but significant number of lesions on the upper leaves	Moderately Resistant
4	Typical susceptible blast lesions, 3 mm or longer infecting less than 4% of leaf area	Moderately Susceptible
5	Typical susceptible blast lesions of 3mm or longer infecting 4-10% of the leaf area	Moderately Susceptible
6	Typical susceptible blast lesions of 3 mm or longer infecting 11-25% of the leaf area	Moderately Susceptible
7	Typical susceptible blast lesions of 3 mm or longer infecting 26-50% of the leaf area	Susceptible
8	Typical susceptible blast lesions of 3 mm or longer infecting 51-75% of the leaf area many leaves are dead	Highly Susceptible
9	Typical susceptible blast lesions of 3 mm or longer infecting more than 75% leaf area affected	Highly Susceptible

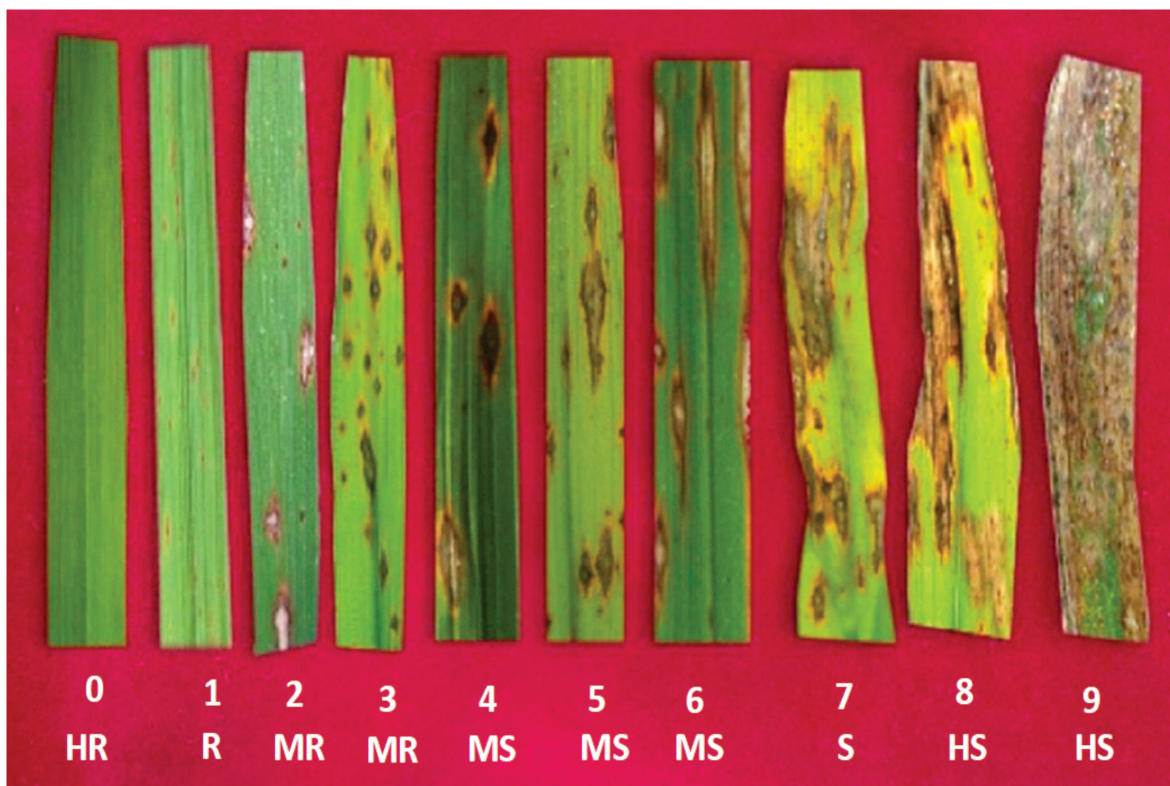


Plate 1: Scale (0-9) used for scoring against leaf blast of rice

Screening of rice genotypes against neck blast and brown spot diseases in Field Nursery pattern: Another experiment was conducted during *Kharif* 2015 at AHRS, Ponnampet. Screening of rice against *P. oryzae*

and *Helminthosporium oryzae* was carried out to know the source of resistance against neck blast and brown spot diseases under natural epiphytotic condition. 354 rice germplasm lines were evaluated against neck blast and brown

spot diseases. These germplasm lines were sown on 16/07/2015 in field nursery pattern. Intan and IR-64 serve as susceptible and resistant check respectively. One line of 25 days old seedlings were uprooted from the nursery bed and planted in the main field over a length of 1.5 meters in two lines with a spacing of 15 x 15 cm. Fertilizers were applied at the rate of 75:75:90 Kg/ha *i.e* basal application at the rate of 37.5:75:45 Kg/ha and top dressing of 37.5:0:45 Kg/ ha respectively. The screening against neck blast and brown spot resistance and disease reactions were recorded using 0-9 scale given below.

Scoring for neck blast was done at harvesting stage by using following scale given by IRRI (1996)

Rating scale	Disease Reaction	Description
0	HR	No incidence
1	R	Less than 5 % infected panicles
3	MR	5-10 % infected panicles
5	MS	11-25 % infected panicles
7	S	26-50 % infected panicles
9	HS	More than 50 % infected panicles

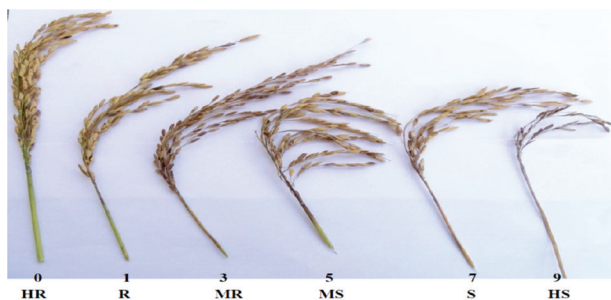


Plate 2: Scale (0-9) used for scoring against neck blast of rice

Scoring for brown spot by using following scale given by IRRI (1996)

Rating scale	Disease severity in per cent leaf area coverage	Host response
0	No incidence	Highly Resistant
1	Less than 1%	Resistant
2	1-3%	Moderately Resistant
3	4-5%	Moderately Resistant
4	6-10%	Moderately Susceptible
5	11-15%	Moderately Susceptible
6	16-25%	Moderately Susceptible
7	26-50%	Susceptible
8	51-75%	Highly Susceptible
9	76-100 %	Highly Susceptible

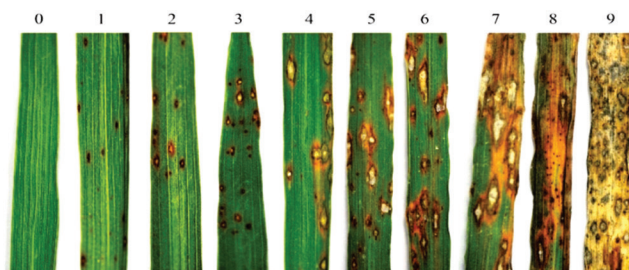


Plate 3: Scale (0-9) used for scoring against Brown spot of rice

RESULTS AND DISCUSSION

Screening of rice genotypes against blast and brown spot diseases in Nurseries: In order to identify the resistant sources, 354 rice genotypes were screened by using 0-9 scale against leaf and neck blast caused by *P. oryzae* under natural epiphytotic condition at AHRS, Ponnampet. The genotypes were grouped into nine classes based on degree of reaction and the number of genotypes falling in particular group and results are presented in Table-1 and Plate-1 respectively.

Among 354 genotypes screened against leaf blast, out of which none of the entries showed entries were found highly resistant, Resistant and moderately resistant reaction to leaf blast. Dhanrasi (NC), IET-24545, CSR 36 (Alkaline), 24538, CSR 23 (Inland saline), 24541, 3209, Tetep (DP), 24443, 23565, 24537, 23782, Jaya (Yield check), 24536, Shobini (NC), US 321 (HS), 23680, 24599, 3211 and 23339 entries were found moderately susceptible reaction to leaf blast. Twenty six entries *i.e.*, IET-24480, 24451, 24474, 23784, CSR 10 (Early), 24547, 23878, 24624, CR SugandhDhan 907-ZC, IR 64 (NC), 24120, 24146, NDR359 (NC), 23272, 23052, 23895, 24008, 24264, 24418, 23767, 24236, 24263, IR 64 (NC), 23949, NDR359 (NC) and Nidhi showed susceptible reactions to the leaf blast. Three hundred four entries *i.e.*, IET-23930, 24471, 23561, 24367, 24450, 24539, FL 478 Check with Saltol 1, 24612, 24614, 24613, 23879, Dubraj (QC), 24103, 23770, 24104, 23216, 23735, 24117, 24122, 24142, 24577, 24575, 24603, Purnendu (ZC), 23906, Sabitha (NC), 23066, CR Dhan 201 (NC), 24028, 24006, PA 6129 (HC), 24036, Jaya (Yield check), 24434, FL 478 Check with Saltol 1, 24766, 24316, 24783, DRRH 3 (HC), 24544, 24772, IR 64 Check, 24779, Chittimuthyalu Check, 24651, 24665, 24640, 24630, 24661, 24639, 24659, 24632, 24385, 24395, 23765, 24284, 24292,

24240, 24241, 24246, 23829, 23834, Chittimuthyalu Check, 23957, Shahbhagidhan (NC), 24075, 24268, 22919, 24309, 24215, 24846, 24343, 24334, 24347, 24318, 24825, MTU 1010 (NC), 24310, 24879, US 312 (HC), 24721, US 314 (HC), 24053, 24727, 24705, Tetep, HR-12, IR-64, 25663, 25666, 25667, 25668, 25672, 25673, 25480, 25481, BPT 5204 (Sensitive check), 22637, 24556, 24616, 24619, Badshabhog (QC), 24606, 24615, 24621, 24623, 24625, 24617, KRH-2 (HC), 23666, 24143, 24596, 24600, 24565, Pusa Basmati 1121 (RP), 24566, Pusa Sugandh-5 (RP), 24570, Pusa Basmati-1 (RP) (YC), Taroari Basmati (QC), 24573, Pusa Basmati-6 (RP), 24576, 23017, 23934, 23053, 23933, 24035, 24003, 23997, 24010, 24425, 23837, 24441, 24430, BPT 5204 (Sensitive check), 24419, 24436, CST 7-1 (Coastal saline), 24424, 24439, 24426, 24771, 24391, 24440, 24777, BPT 5204 check, 24555, 24319, 24760, 24775, 24360, 24438, 24765, 24553, GontraBidhan 3 Check, 24336, kalanamak Check, 24557, 24550, 24774, 24291, 24787, 24636, 24658, 24660, 24670, 24666, 24664, 24273, PA 6444 (HC), 150824238, 24412, 23725, 24274, 24252, Swarna (NC), 24414, 23742, 24261, 24352, 23610, 23752, 24365, 24297, 24234, 24367, 24235, 24374, Kalanamak Check, 23824, BPT 5204 Check, 23832, 23392, 23356, 23976, 23979, 23947, 23354, PA 6129 (HC), 23951, 23996, 24082, 24266, 24326, 24356, 24260, 24817, 24331, 24816, 24359, 24276, 24262, 24844, 24299, 24332, 24814, 24823, 24301, 24333, 24330, 24327, 24855, 24342, 24335, 24354, 24323, 24824, 24355, 24341, 23964, 24340, 24305, 24302, 24311, 1346, 24306, 24338, 24815, 1351, 1352, 1353, 1355, 1357, 901, 902, 903, 904, 905, 906, 907, 908, 910, 911, 912, 913, 914, 917, 918, 920, 923, 924, 925, 929, 930, 931, Co-39, BPT-5204, Vikramarya, Rasi, Ajay, RP- Bio-226, TN-1, Swarnadhan, Benibhog, IR-50, 25664, 25665, Swarna (Recurrent parent), 25669, 25670, Samba Mahsuri Sub-1 (RP), 25671, Swarna Sub-1 (RP), 25674, IR 81896-B-B-195 (DP), 25675, 25676, CO 43 (RP), 24481 (R), 25677, 25678, RANJIT (RP), 25265, BAHADUR (RP), DHMADQ 164-2B (DP), Samba Mahsuri (RP), 24164 (R), C101 LAC (DAP), 25482, 25483, Improved Samba Mahsuri (RP), 24232 (R), 25484, Swarna (RP) and C 101 A 51 (DP) showed highly susceptible reaction to leaf blast respectively (Table 1).

Among 354 genotypes screened against neck blast, out of which thirty seven entries *i.e.*, IET-

23561, 24537, 24545, CSR 36 (Alkaline), CSR 23 (Inland saline), 24606, 23680, 2414, NDR359 (NC), Saita (NC), 23933, 23066, 23052, 23895, 24035, 24008, Jaya (Yield check), 24336, 24630, 24658, 24385, 24365, 24260, 24268, 24816, 24309, 24823, 24825, 24815, 24351, 23656, US 312 (HC), 24796, Tetep, 25663, 25678 and Tetep (DP) found highly resistant to neck blast disease of paddy, Forty entries *i.e.*, IET-23930, 24471, 24536, 24614, 24620, 24625, 23770, IR 64 (NC), US 312 (HC), 23735, KRH-2 (HC), 23666, 24600, 24577, Purnendu (ZC), 23053, CR Dhan 201 (NC), 24036, 24424, 24440, 24319, 24760, 24360, GontraBidhan 3 Check, 24640, 24395, 24418, 23354, PA 6129 (HC), 24082, 22919, 24814, 24327, 24340, HRI 174 (HC), 24338, 24058, Swarnadhan, 25672 and 25676 showed resistant reactions to the neck blast, Sixty eight entries *i.e.*, IET-24443, 24480, 24451, 24474, 23565, 24541, 23878, 24619, Badshabhog (QC), Dubraj (QC), 24617, 24104, 23216, 24117, 24565, Pusa Sugand-5 (RP), 24599, Pusa Basmati (QC), Taroari Basmati (QC), 24573, Pusa Basmati-6 (RP), 23906, 24006, 24319, 24783, Kalanamak Check, Chittimuthyalu Check, 24291, 24651, 24660, 24659, 24632, 23765, 24252, 24284, 23752, 24292, 24374, 23949, 23356, 24075, 23951, 24262, 24844, 24846, 24343, 24855, 24334, 24342, 24355, 24341, 24310, 24879, 24880, 24040, 24729, 24737, 24798, 25663, Swarna (RP), 25670, 25671, 25673, Swarna Sub-1 (RP), 25674, IR 81896-B-B-195 (DP), CO 43 (RP) and 25265 showed moderately resistant reactions to the neck blast.

Sixty one entries *i.e.*, IR-64, Dhanrasi (NC), IET-24367, 24450, 22637, Jaya (yield check), 23784, BPT 2504 (SC), 24547, 24616, 23879, CR SugandhDhan 907- (ZC), 24615, 24621, 24623, 24103, 24122, 24142, 24566, PA06129 (HC), 24771, 24391, 24777, BPT 5204, DRRH 3 (HC), 24553, IR 64 CHECK, 24550, 24661, 24670, 24264, 24352, 24234, 24241, 24246, 23339, 23957, 24299, 24333, 24330, 24347, 24335, 24354, 23964, 24302, 24311, 24306, 24884, 23748, 24704, 24746, 24797, 24721, 24743, 24747, 24705, Vikramarya, 25664, 25668, 25669, Samba Mahsuri Sub-1 (RP) and 24481 (R) showed moderately susceptible reactions to the neck blast. Sixty six entries *i.e.*, IET- 24538, CSR 10 (Early), 24556, 24612, Shobini (NC), 24624, 24146, Pusa Basmati 1121 (RP) (Q& YC), 24570, 24575, 23017, 23997, 24010, 24425,

24441, BPT 5204(SC), CST 7-1 (CS), 24316, 24775, 24557, 24779, 2774, 24787, 24636, 24660, 24639, 24664, 24273, PA 6444 (HC), 23725, Swarna (NC), 24297, 24367, 24235, 24236, 24263, 23829, 23834, 23824, 24780, 3211,23392, 23947, 23996,24266, 24326, 24359,24301, 24355, MTU 1010 (NC), 24305, 24055, 24708, 240532, BPT-5204, Rasi, Ajaya, Benibhog, 25665, 25666,25674, RANJIT (RP), DHMASQ 164-2B (DP), Samba Mahsuri (RP), 25482 and Swarna (RP) showed susceptible reactions to the neck blast.

Eighty entries *i.e.*, IET-23782, 24539, FL 478 Check with Saltol 1, 24613, 24120, NDR359 (NC), 24596, 24576, 24603, 24003, 24028, 23837, 24430, 24419, 24436, 24439, 24426, 24434, FL 478 Check with Saltol 1, 24766, 24438, 24765, 24544, 24772, 24665, 24238, 24412, 24274, 24414, 23742, 24261, 23610, 2367, 24240, IR 64 Check, Kalanamak Check, BPT 5204 Check, 23832, Chittimuthyalu Check, Shahbhagidhan (NC), 23976, 23979, 24353,24817, 24331, 24276, 24332, 24325, NDR359 (NC), 24323, 24318, 24307, 24716, 24744, 24748, 24724, 24742, 24741,US 314 (HC), 24718, 24750, 24727, Co-39, CH-45, Nidhi, HR-12, RP-Bio-226, TN-1, IR-50, IR-64, 25667, BAHADUR (RP), 25480, 25481, 24164 (R), C101 A 51 (DP), 25483, Improved Samba Mahsuri (RP), 24232 (R), 25484 and C 101 A 51 (DP), showed highly susceptible reaction to neck blast respectively (Table 2 and Plate 2). Intan served as susceptible check showed highly susceptible and susceptible reaction to leaf and neck blast respectively. IR-64 served as resistant check showed moderately resistant reactions against leaf and neck blast respectively. To identify the resistant sources against the any disease in order to breed resistant varieties is of primary importance. Wide response of rice genotypes against *P. oryzae* has been earlier observed by various workers (Nagaraju *et al.*, 1991, Saifulla and Manjunath., 1995 and Ghazanfar *et al.*, 2009 and Hosagoudar *et al.*, 2019 and Hosagoudar *et al.*, 2020). Saha (2004) reported that HR-12 showed susceptibility to *P. oryzae* as observed in the present study. Ravi *et al.* (1989) reported that Jaya variety showed high degree of resistant to the blast of rice. The results obtained in the present study are supported by Naik *et al.* (2016) and Hosagoudar (2019) who reported that Intan and HR-12 showed highly susceptible

reaction to blast of rice, while Rasi and IR-64 recorded moderately susceptible reaction to the blast of rice. Barnwal *et al.* (2012) reported and used CO-39 as susceptible variety to blast of rice in experiment to evaluate fungicides.

Among 354 genotypes screened against brown spot, out of which none of the entries found highly resistant and resistant reactions to brown spot disease of paddy, thirty two entries *i.e.*, IET-23565, 24367, 24545, CSR 36 (Alkaline), Jaya (Yield Check), 24536, BPT 5204 (SC), 23735, 23933, 23066, CST 7-1 (CS), 24424, FL 478 Check with Saltol 1, 24777, 24319, DRRH 3 (HC), 24385, 24395, 24412, 23725, Swarna (NC), 24246, 22919, 24309, 24844, 24823, 24340, 24815, 26356, 25676, 25677 and Swarna (RP) showed moderately resistant reactions to the brown spot disease. Eighty nine entries *i.e.*, IET-24480, 24474, 23561, 24541, Shobini (NC),24606, Dubraj (QC), IR 64 (NC),US 312 (HC), 23216, 24122, 23272, 24143, 24264, 24600, 24565, Pusa Sugandh-5 (RP), 24570, Pusa Basmati-1 (RP) (YC), 24573, 24603, Purnendu (ZC), 23934, 23053,23052, 24035, CR Dhan 201 (NC), 24036, 24425, 24441, Jaya (YC), 24419, 24434, 24316, 24440, 24555, 24775, 24783, 24774, 24291, 24273, PA 6444(HC), 23765, 24274, 24252, 24414, 24284, 23610, 24292, 24418, 23767, 24365, 24297, 24235,24374, 24263, 23824, 3211, 23392, 24075, 23354, PA 6129, 24082, 24260, 24814, 24325, 24301, 24327, 24855, 24342, 24341, 24825, HR1 174 (HC), 24338, 24310, 24351,24879, US 312 (HC), US 314 (HC), 24727, 24796, 24798, Tetep,25670, 25672, 25673, CO 43 (RP), DHMASQ 164-2B (DP) and Tetep (DR) showed moderately susceptible reactions to the brown spot disease.

One hundred thirty entries *i.e.*, IET-24443, Dhanrasi (NC), 24451, 23930, 24471, 22637, 24545, 23784, CSR 23 (IS), 24547, 24616, 23878, 24613, 24620, 23879, 24619, CR SugandhDhan 907-ZC, 24615, 24621, 24617, 24103, 23770, 24104, 24120, 24117, 24122, 24142, 23666, 24566, 24599, Pusa Basmati -6(RP), 24576, 23906, 406, 23895, 24003, 24028, 24008, 24006, PA 6129 (HC),24439, 24430, 24436, 24426, 24771, 24391, BPT 5204 Check, 24760, 24438, 24765, 24553, 24544, GontraBidhan 3 Check, 24336, Kalanamak Check, 24651, 24640, 24661, 24658, 24670, 24666, 24632, 24264, 24238, 23742, 24261, 24352, 23752, 24234, 24241, 23339, 23949, 23957, Shahbhagidhan (NC), 23356, 23979,

Table 1: Grouping of Paddy genotypes based on their reaction to Leaf blast under Nursery (NSN-1) conditions

Reaction (SES 0-9 Scale)	Entry No. (Br)
0(HR)	-
1 (R)	-
2(MR)	-
3 (MR)	-
4 (MS)	-
5 (MS)	(8) Dhanrasi (NC), IET-24545, CSR 36 (Alkaline), 24538, CSR 23 (Inland saline), 24541, 3209 and Tetep (DP),
6 (MS)	(12) IET-24443,23565, 24537,23782, Jaya (Yield check), 24536, Shobini (NC),US 321 (HS), 23680, 24599, 3211 and 23339,
7 (S)	(26) IET-24480, 24451, 24474, 23784, CSR 10 (Early), 24547, 23878, 24624, CR SugandhDhan 907-ZC,IR 64 (NC), 24120, 24146, NDR359 (NC), 23272, 23052, 23895, 24008, 24264, 24418, 23767, 24236, 24263, IR 64 (NC), 23949, NDR359 (NC) and Nidhi,
8 (HS)	(95) IET-23930, 24471, 23561, 24367, 24450, 24539, FL 478 Check with Saltol 1, 24612, 24614, 24613, 23879, Dubraj (QC), 24103, 23770, 24104, 23216, 23735, 24117, 24122, 24142, 24577, 24575, 24603, Purnendu (ZC), 23906, Sabitha (NC), 23066, CR Dhan 201 (NC), 24028, 24006, PA 6129 (HC), 24036, Jaya (Yield check), 24434,FL 478 Check with Saltol 1, 24766, 24316, 24783, DRRH 3 (HC), 24544, 24772, IR 64 Check, 24779, Chittimuthyalu Check , 24651, 24665, 24640, 24630, 24661, 24639, 24659, 24632, 24385, 24395, 23765, 24284, 24292, 24240, 24241, 24246, 23829, 23834, Chittimuthyalu Check, 23957,Shahbhagidhan (NC),24075, 24268, 22919, 24309, 24215, 24846, 24343, 24334, 24347, 24318, 24825, MTU 1010 (NC), 24310, 24879, US 312 (HC), 24721, US 314 (HC), 24053, 24727, 24705, Tetep, HR-12, IR-64,25663, 25666,25667, 25668, 25672, 25673,25480, 25481 and BPT 5204(Sensitive check),
9 (HS)	(209) IET-22637, 24556, 24616, 24619, Badshabhog (QC), 24606, 24615, 24621, 24623, 24625, 24617, KRH-2(HC), 23666, 24143, 24596, 24600, 24565, Pusa Basmati 1121 (RP), 24566, Pusa Sugandh-5 (RP), 24570, Pusa Basmati-1 (RP) (YC), Taroari Basmati (QC),24573, Pusa Basmati-6 (RP), 24576, 23017, 23934,23053, 23933, 24035, 24003, 23997, 24010, 24425, 23837, 24441, 24430, BPT 5204 (Sensitive check), 24419, 24436, CST 7-1 (Coastal saline), 24424, 24439, 24426, 24771, 24391, 24440, 24777, BPT 5204 check, 24555, 24319, 24760, 24775, 24360, 24438, 24765, 24553, GontraBidhan 3 Check, 24336, kalanamak Check, 24557, 24550, 24774, 24291, 24787, 24636, 24658, 24660, 24670, 24666, 24664, 24273, PA 6444 (HC), 150824238, 24412, 23725, 24274, 24252, Swarna (NC), 24414, 23742, 24261, 24352, 23610, 23752, 24365, 24297, 24234, 24367, 24235, 24374, Kalanamak Check, 23824, BPT 5204 Check, 23832, 23392, 23356, 23976, 23979, 23947, 23354, PA 6129 (HC), 23951, 23996, 24082, 24266, 24326,24356, 24260, 24817, 24331, 24816, 24359, 24276, 24262, 24844, 24299, 24332, 24814, 24823,24301, 24333, 24330, 24327, 24855,24342, 24335, 24354, 24323, 24824,24355, 24341, 23964, 24340, 24305, 24302, 24311, 1346, 24306, 24338, 24815, 1351, 1352, 1353, 1355, 1357, 901, 902, 903, 904, 905, 906, 907, 908, 910, 911, 912, 913, 914, 917, 918, 920, 923, 924, 925, 929, 930, 931, Co-39, BPT- 5204, Vikramarya, Rasi, Ajay, RP- Bio-226, TN-1, Swarnadhan, Benibhog, IR-50, 25664, 25665, Swarna (Recurrent parent), 25669,25670, Samba Mahsuri Sub-1 (RP), 25671, Swarna Sub-1 (RP),25674, IR 81896-B-B-195 (DP),25675,25676, CO 43 (RP), 24481 (R), 25677, 25678, RANJIT (RP), 25265, BAHADUR (RP),DHMADQ 164-2B (DP), Samba Mahsuri (RP), 24164 (R), C101 LAC (DAP), 25482, 25483, Improved Samba Mahsuri (RP), 24232 (R),25484,Swarna (RP) and C 101 A 51 (DP),

23951, 24817, 24268, 24816, 24276, 24262, 24299, 24332, 24846, 24333, 24343, 24330, 24334, 24347, 24354, 24824, 24318, 23964, 24302, 24311, 24306, 24351, 24880, 24744, 24748, 23748, 24040, 24797, 24724, 24729, 24721, 24741, 24743, 24750, 24747, 24705, 24737, Nidhi, Vikramarya,Swarnadhan, IR-64, 25663, Swarna (RP), 25667, 25668, 25669, Samba Mahsuri Sub-1 (RP), 25671, Swarna Sub-1 (RP), 25675, 24481 (R),25678, 25265, C101 LAC (DP) and 24232 (R), showed susceptible reactions to the brown spot disease. Ninety nine entries *i.e.*, IET- 24450, 23782, 24538, CSR 10 (Early), 24539, 24556, FL 478 Check with saltol 1, 24612, 24614, Badshabhog (QC), 24624, 24623, 24625, 24146, NDR359 (NC), Pusa Basmati 1121(RP) (Q& YC),24577, 24575, 23017, 23997, 24010, 23837,BPT 5204 (SC), 24766, 24360, 24772, IR 64 Check, 24557, 24550, 24779, Chittimuthyalu Check, 24787, 24636, 24665, 24630, 24660, 24639, 24664, 24659, 24240, 24367, 24236, 23829, IR 64 Check , 23834, Kalanamak Check, BPT 5204 Check, 23832, Chittimuthyalu Check, 24780, 23979, 23947, 23996, 24266, 24326, 24353, 24331, 24359, NDR359 (NC), 24335, 24323, 24355, MTU 1010 (NC), 24305, 24307, 24058, 24055, 24716, 24704, 24746, 24742, 24708, 24053, 24718, Co-39, CH-45, BPT-5204, Rasi, Ajaya, HR-12, RP-Bio-226, TN-1, Benibhog, IR-50, 25664, 25665, 25666, 25674,

Table 2 (a): Grouping of Paddy genotypes based on their reaction to Neck Blast & Brown spot under Transplanted Field conditions

Reaction (SES 0-9 Scale)	Entry No. (Br)	
	Neck blast	Brown spot
0 (HR)	(37) IET-23561, 24537, 24545, CSR 36(Alkaline), CSR 23 (Inland saline), 24606, 23680, 2414, NDR359 (NC), Saita (NC), 23933, 23066, 23052, 23895, 24035, 24008, Jaya (Yield check), 24336, 24630, 24658, 24385, 24365, 24260, 24268, 24816, 24309, 24823, 24825, 24815, 24351, 23656, US 312 (HC), 24796, Tetep, 25663, 25678 and Tetep (DP),	-
1 (R)	(40) 23930, 24471, 24536, 24614, 24620, 24625, 23770, IR 64 (NC), US 312 (HC), 23735, KRH-2 (HC), 23666, 24600, 24577, Purnendu (ZC), 23053, CR Dhan 201 (NC), 24036, 24424, 24440, 24319, 24760, 24360, GontraBidhan 3 Check, 24640, 24395, 24418, 23354, PA 6129 (HC), 24082, 22919, 24814, 24327, 24340, HRI 174 (HC), 24338, 24058, Swarnadhan, 25672 and 25676	-
2 (MR)		-
3 (MR)	(68) IET-24443, 24480, 24451, 24474, 23565, 24541, 23878, 24619, Badshabhog (QC), Dubraj (QC), 24617, 24104, 23216, 24117, 24565, Pusa Sugand-5 (RP), 24599, Pusa Basmati (QC), Taroari Basmati (QC), 24573, Pusa Basmati-6-(RP), 23906, 24006, 24319, 24783, Kalanamak Check, Chittimuthyalu Check, 24291, 24651, 24660, 24659, 24632, 23765, 24252, 24284, 23752, 24292, 24374, 23949, 23356, 24075, 23951, 24262, 24844, 24846, 24343, 24855, 24334, 24342, 24355, 24341, 24310, 24879, 24880, 24040, 24729, 24737, 24798, 25663, Swarna (RP), 25670, 25671, 25673, Swarna Sub-1 (RP), 25674, IR 81896-B-B-195 (DP), CO 43 (RP) and 25265,	(32) IET-23565, 24367, 24545, CSR 36 (Alkaline), Jaya (Yield Check), 24536, BPT 5204 (SC), 23735, 23933, 23066, CST 7-1 (CS), 24424, FL 478 Check with Saltol 1, 24777, 24319, DRRH 3 (HC), 24385, 24395, 24412, 23725, Swarna (NC), 24246, 22919, 24309, 24844, 24823, 24340, 24815, 26356, 25676, 25677 and Swarna (RP),
4 (MS)		
5 (MS)	(61) IET-Dhanrasi (NC), 24367, 24450, 22637, Jaya (yield check), 23784, BPT 2504 (SC), 24547, 24616, 23879, CR SugandhDhan 907- (ZC), 24615, 24621, 24623, 24103, 24122, 24142, 24566, PA06129 (HC), 24771, 24391, 24777, BPT 5204, DRRH 3 (HC), 24553, IR 64 CHECK, 24550, 24661, 24670, 24264, 24352, 24234, 24241, 24246, 23339, 23957, 24299, 24333, 24330, 24347, 24335, 24354, 23964, 24302, 24311, 24306, 24884, 23748, 24704, 24746, 24797, 24721, 24743, 24747, 24705, Vikramarya, 25664, 25668, 25669, Samba Mahsuri Sub-1 (RP) and 24481 (R),	(89) IET-24480, 24474, 23561, 24541, Shobini (NC), 24606, Dubraj (QC), IR 64 (NC), US 312 (HC), 23216, 24122, 23272, 24143, 24264, 24600, 24565, Pusa Sugandh-5 (RP), 24570, Pusa Basmati-1 (RP) (YC), 24573, 24603, Purnendu (ZC), 23934, 23053, 23052, 24035, CR Dhan 201 (NC), 24036, 24425, 24441, Jaya (YC), 24419, 24434, 24316, 24440, 24555, 24775, 24783, 24774, 24291, 24273, PA 6444 (HC), 23765, 24274, 24252, 24414, 24284, 23610, 24292, 24418, 23767, 24365, 24297, 24235, 24374, 24263, 23824, 3211, 23392, 24075, 23354, PA 6129, 24082, 24260, 24814, 24325, 24301, 24327, 24855, 24342, 24341, 24825, HRI 174 (HC), 24338, 24310, 24351, 24879, US 312 (HC), US 314 (HC), 24727, 24796, 24798, Tetep, 25670, 25672, 25673, CO 43 (RP), DHMASQ 164-2B (DP) and Tetep (DR),
6 (MS)		
7 (S)	(66) IET-24538, CSR 10(Early), 24556, 24612, Shobini (NC), 24624, 24146, Pusa Basmati 1121(RP) (Q& YC), 24570, 24575, 23017, 23997, 24010, 24425, 24441, BPT 5204(SC), CST 7-1 (CS), 24316, 24775, 24557, 24779, 2774, 24787, 24636, 24660, 24639, 24664, 24273, PA 6444 (HC), 23725, Swarna (NC), 24297, 24367, 24235, 24236, 24263, 23829, 23834, 23824, 24780, 3211, 23392, 23947, 23996, 24266, 24326, 24359, 24301, 24355, MTU 1010 (NC), 24305, 24055, 24708, 240532, BPT-5204, Rasi, Ajaya, Benibhog, 25665, 25666, 25674, RANJIT (RP), DHMASQ 164-2B (DP), Samba Mahsuri (RP), 25482 and Swarna (RP),	(130) IET-24443, Dhanrasi (NC), 24451, 23930, 24471, 22637, 24545, 23784, CSR 23 (IS), 24547, 24616, 23878, 24613, 24620, 23879, 24619, CR SugandhDhan 907-ZC, 24615, 24621, 24617, 24103, 23770, 24104, 24120, 24117, 24122, 24142, 23666, 24566, 24599, Pusa Basmati -6(RP), 24576, 23906, 406, 23895, 24003, 24028, 24008, 24006, PA 6129 (HC), 24439, 24430, 24436, 24426, 24771, 24391, BPT 5204 Check, 24760, 24438, 24765, 24553, 24544, GontraBidhan 3 Check, 24336, Kalanamak Check, 24651, 24640, 24661, 24658, 24670, 24666, 24632, 24264, 24238, 23742, 24261, 24352, 23752, 24234, 24241, 23339, 23949, 23957, Shahbhagidhan (NC), 23356, 23979, 23951, 24817, 24268, 24816, 24276, 24262, 24299, 24332, 24846, 24333, 24343, 24330, 24334, 24347, 24354, 24824, 24318, 23964, 24302, 24311, 24306, 24351, 24880, 24744, 24748, 23748, 24040, 24797, 24724, 24729, 24721, 24741, 24743, 24750, 24747, 24705, 24737, Nidhi, Vikramarya, Swarnadhan, IR-64, 25663, Swarna (RP), 25667, 25668, 25669, Samba Mahsuri Sub-1 (RP), 25671, Swarna Sub-1 (RP), 25675, 24481 (R), 25678, 25265, C101 LAC (DP) and 24232 (R),
8 (HS)		

Reaction (SES 0-9 Scale)	Entry No. (Br)	
	Neck blast	Brown spot
9 (HS)	(80) IET-23782, 24539, FL 478 Check with Saltol 1, 24613, 24120, NDR359 (NC), 24596, 24576, 24603, 24003, 24028, 23837, 24430, 24419, 24436, 24439, 24426, 24434, FL 478 Check with Saltol 1, 24766, 24438, 24765, 24544, 24772, 24665, 24238, 24412, 24274, 24414, 23742, 24261, 23610, 2367, 24240, IR 64 Check, Kalanamak Check, BPT 5204 Check, 23832, Chittimuthyalu Check, Shahbhagidhan (NC), 23976, 23979, 24353, 24817, 24331, 24276, 24332, 24325, NDR359 (NC), 24323, 24318, 24307, 24716, 24744, 24748, 24724, 24742, 24741, US 314 (HC), 24718, 24750, 24727, Co-39, CH-45, Nidhi, HR-12, RP-Bio-226, TN-1, IR-50, IR-64, 25667, BAHADUR (RP), 25480, 25481, 24164 (R), C101 A 51 (DP), 25483, Improved Samba Mahsuri (RP), 24232 (R), 25484 and C 101 A 51 (DP),	(99) IET-24450, 23782, 24538, CSR 10 (Early), 24539, 24556, FL 478 Check with saltol 1, 24612, 24614, Badshabhog (QC), 24624, 24623, 24625, 24146, NDR359 (NC), Pusa Basmati 1121 (RP) (Q& YC), 24577, 24575, 23017, 23997, 24010, 23837, BPT 5204 (SC), 24766, 24360, 24772, IR 64 Check, 24557, 24550, 24779, Chittimuthyalu Check, 24787, 24636, 24665, 24630, 24660, 24639, 24664, 24659, 24240, 24367, 24236, 23829, IR 64 Check, 23834, Kalanamak Check, BPT 5204 Check, 23832, Chittimuthyalu Check, 24780, 23979, 23947, 23996, 24266, 24326, 24353, 24331, 24359, NDR359 (NC), 24335, 24323, 24355, MTU 1010 (NC), 24305, 24307, 24058, 24055, 24716, 24704, 24746, 24742, 24708, 24053, 24718, Co-39, CH-45, BPT-5204, Rasi, Ajaya, HR-12, RP-Bio-226, TN-1, Benibhog, IR-50, 25664, 25665, 25666, 25674, RANJIT (RP), BAHADUR (RP), 25480, 25481, Samba Mahsuri (RP), 24164 (R), 25482, 25483, Improved Samba Mahsuri (RP), 25484 and C 101 A 51 (DP),

RANJIT (RP), BAHADUR (RP), 25480, 25481, Samba Mahsuri (RP), 24164 (R), 25482, 25483, Improved Samba Mahsuri (RP), 25484 and C 101 A 51 (DP) showed highly susceptible reaction to the brown spot disease respectively (Table 2 and Plate 2).

Wide response of rice genotypes against *Helminthosporium oryzae* has been earlier observed by various workers Arshad *et al.* (2008) were evaluated seventy genotypes/entries/varieties, among that only one Basmati entry, PK-3699-43 of PARC was found resistant, while all other remaining varieties/entries were found moderately resistant to highly susceptible. Hosagoudar *et al.*, 2019 were evaluated 244 genotypes/entries/varieties, among that only 3 entries *i.e.*, IET-23403, 22876 and 23392 were found resistant reaction to brown spot disease. The remaining entries were found moderately resistant to highly susceptible reaction to brown spot disease.

Mother *et al.* (2013) screened five rice cultivars, one hybrid (WR96), three modern (BR16, BR26, and BRRI Dhan27) and one local (Pari) were screened for their reaction to brown leaf spot disease caused by *Cochliobolus miyabeanus* and their performance on yield-related characters. The severity of brown leaf spot varied with growth stages of rice plant as well as different cultivars tested under field condition. Low disease severity was observed at maximum tillering stage compared to moderate

to high at dough stage, with hybrid cultivar WR96 showing highest disease, while local cultivar Pari had the lowest.

References

- ANONYMOUS, 1981, Package of practices for high yields. Univ. Agric. Sci. Bangalore.
- ANONYMOUS, 2019, the area under cultivated rice in India. Ministry of Agriculture and Farmers Welfare, GOI, New Delhi, www.India stat.com.
- BARNWAL, M. K., VAIBHAV, K. S., SHARMA, R. B. AND SINGH, B. N., 2012, Field evaluation of rice genotypes for resistance and new fungicides for control of blast (*Pyricularia oryzae*). *Indian Phytopathol.*, 65(1): 56-59.
- GHAZANFAR, M. U., WAKIL, W., SAHI, S. T. AND YASIN, S., 2009, Influence of various fungicides on the management of rice blast disease. *Mycopath.*, 7(1): 29-34.
- HOSAGOUDAR, G. N., 2019, Selection of host plant resistance genotypes in paddy for blast and Brown spot diseases in hilly zone of Karnataka. *International Journal of Recent Scientific Research*, 10(04): 31978-31982.
- HOSAGOUDAR, G. N., SHESHIAIAH, BASAVARAJ S. KOVI AND UMESH BABU., B.S., 2019, Evaluation of Host Plant Resistance for Blast and Brown Spot Diseases of Paddy in Hill Zone of Karnataka, India, *Int. J. Curr. Microbiol. App. Sci.*, 8(3): 1294-1304.
- HOSAGOUDAR, G. N., SHIVAPRASAD, M. AND KENCHARADDI, R. N., 2020, Evaluation of Host Plant Resistance for Blast of Rice in Hilly Zone of Karnataka. *International Journal of Tropical Agriculture*, Vol. 38(4): 383-387.

- INTERNATIONAL RICE RESEARCH INSTITUTE (IRRI), 1996, Standard evaluation system for rice. 4th.ed. IRRI, Manila, Phillipine.
- MCRAE, W., 1922, Report of the Imperial Mycologist Scientific Report, Pusa Agricultural Research Institute, p. 44-50.
- NAGARAJU, P., VASANTAKUMAR, H. C., DEVAIAH, B. M., SESHADRI, V. S. AND NAIDU, B. S., 1991, Evaluation of rice genotypes for blast and sheath rot resistance in hilly regions of Karnataka, *Mysore J. Agric. Sci.*, **25**: 139-141.
- NAIK, G. R., DINESH, K. M., NAIK, G. B. AND NAIK, B. T., 2016, Field evaluation of high yielding and local paddy cultivars of farmers seeds source in southern transitional zone (zone-7) of Karnataka against blast disease. *I.J.A.B.R.*, **6**(1): 21-24.
- PADMANABHAN, S. Y., 1965, Breeding for blast resistance in India. In 'The rice blast disease', Ed. Johns Hopkins Press, Baltimore and Maryland, USA, pp. 203-221.
- *RAVI, K., MISHRA, R. P. AND DIWAKAR, M. C., 1989, Field reaction of some varieties to blast in Karnataka., *Pl. Prot. Bull.*, Faridabad, **4**: 13-14.
- SAHA, S., 2004, Behavior of rice varieties against leaf blast disease in rainfed upland conditions of West Bengal. *J. Mycopathol. Res.*, **42**(2): 205-206.
- SAIFULLA, M. AND MANJUNATH, A., 1995, Assessment of rice genotypes to blast disease. *Agric. Sci. Dig.*, **15**: 151-152.
- ARSHAD, H. M. I., KHAN, J. A. AND JAMIL, F.F., 2008, Screening of rice germplasm against blast and brown spot disease. *Pak. J. Phytopathol.*, **20** (1):52-57.
- SAVARY, R. A., 1959, Nomenclature of *Drechslera* and *Bipolaris*, grass parasites segregated from *Helminthosporium*. *Candisian J. Bot.*, **37**:879-87.